Zagazig J. Agric. Res., Vol. 51 No. (1) 2024 55-76

Soil Science and Agricultural Engineering

Available online at http://zjar.journals.ekb.eg
http:/www.journals.zu.edu.eg/journalDisplay.aspx?Journalld=1&queryType=Master

IMPROVING N-FERTILIZATION EFFICIENCY FOR BARLEY PLANT GROWN ON SANDY CALCAREOUS SOIL BY USING ORGANIC AND BIOFERTILIZERS

Marwa M. Elsayed[1*], S.M. Dahdouh[2], M.A. Poraas[1] and M.M. Elsawy[2]

1. Soil, Water and Environ. Res. Inst., Agric. Res. Cent., Egypt
2. Soil Sci. Dept., Fac. Agric., Zagazig Univ., Egypt

Received: 11/02/2024; Accepted: 22/02/2024

ABSTRACT: A pot experiment was carried out for investigating the possibility of partial or entire replacement of mineral nitrogen fertilizers with organic and biofertilizers, aiming to improve the efficiency of nitrogen fertilization for barley plant grown on sandy calcareous soil collected from Agriculture Research Station in Nubariya. Mineral nitrogen fertilizer was added at the rates 30, 60, 90 and 120 mg N kg soil^{-1}. Phosphorus and potassium were added at the recommended rates of 15 mg P and 30 mg K kg soil^{-1}, respectively. Organic fertilizers were added from different sources "compost, chicken manure and pigeon dung" at a rate of 30 mg kg N soil^{-1} based on their nitrogen content. Biofertilization was achieved through the addition of 5g pot^{-1} serialin or/and 5g pot^{-1} phosphorene; mixed thoroughly with soil. Upon the observed data, the highest dry matter yield was obtained when "compost + serialin" were applied to the soil in combination with mineral-N at addition level of "90 mg N kg soil^{-1}". The highest nitrogen uptake was obtained when the soil was treated with "chicken manure + serialin" combined with mineral-N at addition level of 60 mg N kg soil^{-1}. The highest phosphorus uptake was obtained when soil treated with "chicken manure + phosphorine" combined with mineral-N at level of 60 mg N kg soil^{-1}. The highest potassium uptake was obtained when soil was treated with "chicken manure + serialin" combined with mineral-N at level of 90 mg N kg soil^{-1}. The highest yield of straw and grains as well as protein content were obtained when soil was treated with "chicken manure + serialin" combined with mineral-N at level of 60 mg N kg soil^{-1}.

Key words: Nitrogen fertilization, barley, sandy calcareous, organic and biofertilizers.

INTRODUCTION

Barley is the fifth most versatile cereal grain in the world regarding dry matter yield and is considered an essential source of food worldwide **(Gupta *et al.*, 2010)**. Because barley contains β-glucans, which have been shown in recent research to have various health benefits, including barley in human food should be strongly recommended **(Kaur and Das, 2015)**.

Sand calcareous soils have high content of calcium carbonate and are mostly found in both hemispheres' semi-arid and arid subtropics, **(Wahba *et al.*, 2019)**. Sand calcareous soils usually have low levels of total nitrogen and organic matter. Additionally, owing to its high pH, phosphate, zinc, and iron are unavailable **(Fuehring, 1973)**.

Mineral N fertilizers are applied to enhance the natural soil nutrient supply and compensate for the minerals lost by plant product removal, leaching, or gaseous loss to supplement the needs of crops with high yield potential and provide commercially viable yields **(IFIA, 2000)**. Farmers focus has shifted to organic fertilizers owing to the rising costs of inorganic fertilizers. These organic sources improve soil fertility by potentially enhancing the physicochemical qualities of the soil, which include nutrient availability and plant absorption **(Muhammad and Khattab, 2009)**.

*** Corresponding author: Tel. :**+201148636567
E-mail address: elzagndy@gmail.com

Organic manures are used aiming to increasing soil organic matter content, lowering pH and EC, and providing the nutrient elements for plant growth, **(Mahmoud *et al.*, 2004)**. As an example of an organic soil amendment that can enhance and replace the use of chemical fertilizer, compost can provide both macro and micronutrients which can promote the crops' efficient uptake of nutrients **(Martin and Macrae, 2014)**.

Biofertilization is made up mostly of sufficient amounts of patent strains of microorganisms. These bacteria play specific positive roles in seedling growth and soil fertility in the rhizosphere, **(Saber, 1993)**. Biofertilizer inoculation is considered to reduce the need for mineral fertilizers and is an advantageous method for soil development, lowering agricultural expenditures, and increasing crop output since it gives crops access to readily available nutrients **(Metin *et al.*, 2010)**. To minimize negative effects on the soil, minimize intensive chemical fertilizer usage, and optimize soil fertilizer use efficiency, it is believed that integrating biofertilizers with mineral fertilizers is the optimum choice **(Singh *et al.*, 1999)**.

To improve the effectiveness of nitrogen fertilization for barley plants grown on sandy calcareous soil, the current study investigated the possibility of substituting organic and biofertilizers for mineral nitrogen fertilizers, either entirely or in part, for barley plant fertilization under various levels of mineral-N.

MATERIALS AND METHODS

Investigating the possibilities of partially or completely replacing organic and biofertilizers for barley plant fertilization at varying levels of mineral-N, a pot experiment was carried out in a greenhouse. Dry matter yield, uptake of macro nutrient, protein content and yield productivity of barley plant *(Hordeum Vulgare* Giza 123) were measured.

Soil Characteristics

Soil texture was sandy loam contented (16.5%) calcium carbonate and (0.31%) organic matter. The collection of soil samples was done from Nubaria Stations, Agriculture Research Center. Some physical and chemical properties of the soil used are shown in Tables 1, 2 and 3.

Mineral Fertilizers

The recommended addition rates for potassium and phosphorus were 15 mg P and 30 mg K kg soil^{-1}, respectively. Phosphorus was added as ordinary super phosphate (6.5% P) at rate of 15 mg P kg soil^{-1} before sowing. Potassium was added as potassium sulphate (41% K) at rate of 30 mg K kg soil^{-1} in two equal doses; before sowing and at booting stage. Nitrogen was added as ammonium nitrate (33.5% N) at the rates of 30, 60, 90 and 120 mg N kg soil^{-1}.

Organic Fertilizers

Organic N sources; compost (13.3 g N kg^{-1}), chicken manure (25.8 g N kg^{-1}) and pigeon dung (32.1 g N kg^{-1}) were added at the rate of 30 mg N kg soil^{-1}. The applied quantities of these sources were calculated according to their total N content. Some chemical analyses of these organic fertilizers are shown in Table 4.

Biofertilizers

Biofertilizers were commercially produced at Soil Microbiology Unit, Research Institute of Soil, Water and Environments, Agricultural Research Center. Biofertilization was achieved through the addition of 5g pot^{-1} serialin or /and 5g pot^{-1} phosphorene; mixed thoroughly with soil, "5 cm depth from the surface".

Treatments of the Study

Treatments were arranged as the simplest possible combination between organic fertilizer, bio-fertilizer and mineral N fertilizer as following:

1) Mineral nitrogen, 2) Compost + Serialin, 3) Compost+Phosphorene, 4) Compost+ Serialin + Phosphorene, 5) Chicken manure + Serialin, 6) Chicken manure + Phosphorene, 7) Chicken manure + Serialin + Phosphorene, 8) Pigeon dung + Serialin, 9) Pigeon dung + Phosphorene, 10) Pigeon dung + Serialin + Phosphorene.

Seven kilograms of dirt were placed into closed-bottom plastic pots with internal measurements of 25 and 20 centimeters. Twenty barley grains were planted per pot and after germination; plants were thinned to five plants for each pot. Adjustment of soil moisture content was done after germination to be around soil field capacity.

Table 1. Physical properties of the soil used

Mechanical analysis					$CaCO_3$ (%)	OM (%)	F.C (%)
Clay (%)	Silt (%)	Coarse sand (%)	Fine sand (%)	Textural Class			
12.3	18.2	21.4	48.1	Sandy Loam	16.5	0.31	17.1

Table 2. Chemical properties of the soil used

EC* (dsm^{-1})	pH**	Soluble ions (me L^{-1}) *							
		Cations				Anions			
8.63	7.95	Na^+	K^+	Ca^{2+}	Mg^{2+}	Cl^-	HCO_3^-	CO_3^{2-}	SO_4^{2-}
		41.30	5.42	23.16	19.25	49.71	15.62	Nil	23.80

*In soil paste extract **Suspension 1:2.5 Soil : Water

Table 3. Nutrients concentration of the soil used

Available Macronutrients (mg kg^{-1} soil)			Total Micro nutrients (mg kg-1 soil)		
Nitrogen	Phosphorus	Potassium	Iron	Manganese	Zinc
277	11.5	8.6	523	19.2	1.6

Table 4. Chemical analysis of different organic fertilizers used

Characteristic / Organic fertilizers	EC* dsm^{-1}	pH**	Organic matter (g kg^{-1})	C / N Ratio	Total N (g kg^{-1})	Total P (g kg^{-1})	Total K (g kg^{-1})
Compost	3.74	7.55	316.4	14.65	13.3	9.6	9.3
Chicken Manure	3.75	6.37	538.7	12.43	25.8	4.1	3.1
Pigeon dung	3.03	6.60	184.2	10.76	32.1	2.8	9.4

* Water extract of 1 : 10 organic fertilizers : water ** Suspension of 1 : 10 organic fertilizers : water.

Experimental Design

A randomized complete block "factorial" design with three replicates was used, involving two factors which are:

1) Nitrogen sources "mineral - organic - bio".

2) Mineral-N addition rates.

Plant Samples

Three different growth stages *i.e.* 45, 75, and 140 days after planting, which correspond to tillering and booting respectively, were selected to gather plant samples. Dried plant samples as well as grains were wet digested for determining macronutrients (N, P and K).

Methods of Analysis

The analyses of soil, organic fertilizers and plant samples were conducted according to the following methods:

Soil Analysis

The modified Walkly and Black method, was used to determine the organic matter content of the soil **(Page *et al.*, 1982)**. The MgO-Devarda alloy was used in a steam-distillation procedure to measure the amount of total nitrogen, following:

The procedures outlined by Bremner and Keency **(Black, 1982).** 0.5 N NaHCO3 with a pH adjustment to 8.5 was used to extract the total phosphorus, which was then measured calorimetrically using ascorbic acid techniques **(Watanabe and Olsen, 1965).** According to **Jackson (1973)**, available potassium was extracted using 1 N ammonium acetate with a pH adjustment to 7.0 and measured using a flame photometer.

Fertilizers analysis

Water suspension of organic fertilizer was used to determine pH using a glass electrode pH meter in a ratio of 1: 10 **(Jackson, 1973)**. The organic fertilizer's electric conductivity (EC) was determined using water extracts at a ratio of 1:10 as described by **Jackson (1973)**. The traditional micro Kjeldahl method was used to calculate total nitrogen **(Jackson, 1973)**. At a wavelength of 882 nm, total phosphorus was measured using a calorimetric method as per **(Olsen and Sommers, 1982)**. A flame photometer was used to determine the total potassium content in accordance with **(Jackson, 1973)**. As per **(Hesse, 1971)** description, Walkly and Black's method was utilized to determine the total carbon content (g kg^{-1}).

Plant analysis

Using the micro Kjeldahl method as described by **Chapman and Pratt (1978)**, the total nitrogen content was ascertained. Using the ascorbic acid techniques, the total phosphorus concentration was calculated calorimetrically in accordance with **John (1970)**. Using a flame photometer, the total potassium concentration was calculated volumetrically in accordance with **Brown and Lilliland (1964)**. For barley grains, the protein content "yield quality" was determined by multiplying the N content by 5.7, per **(Bishni and Hughes, 1979)**.

Statistical Analysis

Data were evaluated using statistical methods in accordance with **Snedecor and Cochran (1988)**. Least significant method was used to compare treatment means. The significance level for the Differences (LSD) test was set at 0.05 **(Waller and Duncan, 1969)**. The analysis of variance technique of the computer software package **(MSTAT-C, 1991)** was used to do statistical analysis.

RESULTS AND DISCUSSION

Dry Matter Yield of Barley as Affected by Organic and Biofertilization under Different Levels of Mineral-N at Different Growth Stages

Concerning the effect of mineral-N addition, data presented in Tables 5 and 6 reveals that the individual addition of mineral nitrogen up to the level of 120 mg N kg $soil^{-1}$ generally increased the dry matter yield; and this was found true at tillering and booting stages. In this concern, **Mostafa (2001)** found that the addition of N fertilizers significantly increased the dry matter yield of barley plant. **Mohammed (2002)** noted that adding N-fertilizer up to the level of 50.4 kg ha^{-1} increased the dry weight of wheat plants. **Allam (2005)** examined how various nitrogen fertilization levels (12.6, 25.2, 37.8, and 50.4 kg N ha^{-1}) affected the growth of many wheat cultivars. He found that the wheat cultivars that were subjected to higher nitrogen fertilization levels showed a substantial increase in growth as compared to the control group, which received (12.6 kg N ha^{-1}). **Koriem (2008)** mentioned that increasing N addition level up to 42 kg ha^{-1} significantly increased dry matter accumulation of wheat plant.

Regarding the highest dry matter yield, at tillering stage the highest value "0.408 g pot^{-1}" was observed under the addition level of 120 mg N kg $soil^{-1}$; while the lowest value " 0.272 g pot^{-1}" was observed under the addition level of 30 mg N kg $soil^{-1}$. Regarding to booting stage, the highest dry matter yield "0.878g pot^{-1}" was recorded under the addition level of 90 mg N kg $soil^{-1}$; while the lowest value "0.342 g pot^{-1}" was recorded under the addition level of 30 mg N kg $soil^{-1}$. Observed data is in confirmation with those found by **Seadh and Badawi (2007)** who investigated the impact of five different nitrogen fertilizer levels on the dry weight of wheat and discovered that the highest value of dry weight resulted from fertilizing wheat plants by 262 kg N ha^{-1}. **Borham (2008)** revealed that fertilizing wheat plants with 50.4 kg N ha^{-1} resulted in the maximum means of all wheat development parameters. Conversely, the plots with the lowest N fertilizer amount (25.2 kg N ha^{-1}) had the lowest levels of these traits. **Thirupathi *et al.* (2016)** noted that dry matter accumulation (g $plant^{-1}$) of maize was substantially higher under the addition of 225 kg N ha^{-1} than 180 kg N ha^{-1}.

Table 5. Dry matter yield (g pot^{-1}) of barley at tillering stage as affected by organic and biofertilization under different levels of mineral N

Mineral - N rates Nitrogen Sources	30 mg N kg soil^{-1}	60 mg N kg soil^{-1}	90 mg N kg soil^{-1}	120 mg N kg soil^{-1}	Mean
Mineral – N	0.272	0.344	0.382	0.408	0.352
Compost + Serialin	1.421	1.643	1.822	2.311	1.799
Compost + Phosphorene	1.184	1.271	1.459	1.477	1.348
Compost + Serialin+ Phosphorene	1.383	1.506	1.712	2.192	1.698
Chicken manure + Serialin	0.527	0.683	0.879	1.673	0.941
Chicken Manure + Phosphrene	0.594	0.742	0.827	0.958	0.780
Chicken Manure + Serialin + Phosphorene	0.687	0.792	0.842	0.931	0.813
Pigeon dung + Serialin	0.433	0.517	0.678	1.129	0.689
Pigeon dung + Phosphrene	0.362	0.372	0.438	0.541	0.428
Pigeon dung + Serialin+ Phosphorene	0.506	0.531	0.664	0.826	0.632
Mean	0.737	0.840	0.970	1.245	
L.S.D	***NT 0.1426 **NR 0.0902 NT × NR 0.2853**				

*NT: nitrogen treatments ** NR: nitrogen rates

Table 6. Dry matter yield (g pot^{-1}) of barley at booting stage as affected by organic and biofertilization under different levels of mineral-N

Mineral - N rates Nitrogen Sources	30 mg N kg soil^{-1}	60 mg N kg soil^{-1}	90 mg N kg soil^{-1}	120 mg N kg soil^{-1}	Mean
Mineral – N	0.342	0.406	0.878	0.741	0.592
Compost + Serialin	2.767	3.159	5.323	3.679	3.732
Compost + Phosphorene	1.655	2.052	4.640	2.064	2.603
Compost + Serialin+ Phosphorene	2.113	2.546	5.032	3.398	3.272
Chicken manure + Serialin	2.595	2.876	3.448	3.442	3.090
Chicken Manure + Phosphrene	0.817	0.918	1.204	1.147	1.022
Chicken Manure + Serialin + Phosphorene	1.272	1.944	4.039	2.614	2.467
Pigeon dung + Serialin	1.142	1.247	3.554	1.719	1.916
Pigeon dung + Phosphrene	0.453	0.459	1.195	1.096	0.801
Pigeon dung + Serialin+ Phosphorene	0.511	0.776	1.692	0.962	0.985
Mean	1.367	1.638	3.087	2.099	
LSD	**NT 0.0412 NR 0.0260 NT × NR 0.0823**				

Concerning the effect of organic and biofertilizers, data reveals that the dry matter yield significantly increased at tillering and booting stages. In this regard, **Basyouny (2001)** noted that the addition of organic materials residues increased the dry matter matter yield of barley plants. **Aziz *et al.* (2010)** mentioned that organic manure substantially improved the plant growth, mainly dry matter yield, and this improvement was probably due to increased soil nutrient availability and uptake by plants. **El-Guibali -Amal (2016)** reported that the application of 4.2 m^3 compost ha^{-1} significantly increased N contents in the grains and straw of wheat plants. **Achari *et al.* (2021)** found that higher dry weight (19.58 g) was observed with the treatment *Azotobacter* + *Azospirillum* + 140 kg/ha N. Inoculation of biofertilizers stimulated the activation of hormones which help in shoot and root elongation and high dry matter production.

Regarding the highest dry matter yield, at tillering stage, the highest value "2.311 g pot^{-1}" was observed under the treatment of "compost + serialin" at the addition level of 120 mg mineral N kg $soil^{-1}$ compared with "0.408 g pot^{-1}" under the addition of individual mineral-N. At booting stage, the maximum value of dry matter yield "5.323 g pot^{-1}" was recorded under the treatment of " compost + serialin " at the addition levels of 90 mg mineral N kg $soil^{-1}$ compared with" 0.878 g pot^{-1}" under the addition of individual mineral-N. The obtained data is consistent with the studies conducted by **Amin and Leitch (2009)** who assessed the relative efficiency of organic manure on spring barley production, and they found that organic manure gave the highest values of dry matter production.

Macronutrients Uptake by Barley as Affected by Organic and Biofertilization Under Different Levels of Mineral-N at Different Growth Stages

Nitrogen uptake

Regarding the effect of mineral nitrogen addition**,** data presented in Tables 7, 8, 9 and 10 indicates that the individual addition of mineral nitrogen up to the level of 120 mg N Kg $soil^{-1}$ generally increased the N uptake; and this was found true at all growth stages under study. In this regard, **Amer** (**2005**) stated that N uptake by wheat at booting and maturity stages increased with increasing fertilization up to 50.4 kg N ha^{-1} in normal soil. **Abu-Grab *et al.* (2006)** stated that adding N fertilizers at the level of 90 kg N increased N uptake of wheat. According to **Antoun *et al.* (2010)**, there was a significant increase in the amount of nitrogen absorbed by the wheat plant's grains and straw when the amount of mineral nitrogen fertilizer was increased from 10.5 to 21, 31.5, and 42 kg N ha^{-1}. According to **Mosaad *et al.* (2013)**, applying mineral fertilizer rates up to 37.8 kg N ha^{-1} enhanced the amount of N absorbed by wheat grains and straw.

Concerning the highest N uptake, at tillering stage, the highest value "11.56 mg pot^{-1}" was recorded under the addition level of 120 mg N kg $soil^{-1}$; while the lowest value "5.11 mg pot^{-1}" was recorded under the addition level of 30 mg N kg $soil^{-1}$.

Regarding the booting stage, the highest N uptake "13.86 mg pot^{-1}" was observed under the addition level of 90 mg N kg $soil^{-1}$; while the lowest value "7.76 mg pot^{-1}" was observed under the addition level of 30 mg N kg $soil^{-1}$. At the maturity stage, the highest N uptake of straw and grain "20.02 and 61.21 mg pot^{-1}, respectively" were obtained under the addition level of 60 mg N kg $soil^{-1}$; while the lowest values "17.05 and 36.22 mg pot^{-1}" were obtained under the addition level of 30 mg N kg $soil^{-1}$. In this regard, **Faizy *et al.* (2010)** stated that N uptake by wheat grains and straw increased with increasing N addition level up to 58.8 kg ha^{-1}, and the highest values were "2.41 and 5.97 kg ha^{-1}" under the application of 58.8 kg ha^{-1}; and the lowest values were "2.15 and 1.28 kg ha^{-1}" for N uptake by grain and straw respectively, at zero N application. **Youssef *et al.* (2011)** reported that an addition level of 37.8 kg N ha^{-1}, wheat grain exhibited the maximum N uptake, measuring 20.61 kg N ha^{-1}. **El-Hamdi *et al.* (2012)** reported that increasing N application led to a considerable increase in N uptake by wheat grain and straw. The greatest results, 20.15 and 23.67 kg N ha^{-1} for grains and straw, respectively, were recorded when 31.5 kg N ha^{-1} was used. **Ayadi *et al.* (2014)** mentioned that wheat grains uptake of nitrogen rose dramatically as nitrogen application increased; and the application of 150 kg N ha^{-1} resulted in the maximum nitrogen uptake by grains (104.5 kg ha^{-1}).

Table 7. Nitrogen uptake (mg pot^{-1}) by barley at tillering stage as affected by organic and biofertilization under different levels of mineral-N

Mineral - N rates Nitrogen Sources	30 mg N kg $soil^{-1}$	60 mg N kg $soil^{-1}$	90 mg N kg $soil^{-1}$	120 mg N kg $soil^{-1}$	Mean
Mineral – N	5.11	8.58	10.33	11.56	8.90
Compost + Serialin	36.34	39.63	41.24	54.10	42.83
Compost + Phosphorene	26.13	28.29	31.56	37.63	30.90
Compost + Serialin+ Phosphorene	31.98	34.57	40.93	48.20	38.92
Chicken manure + Serialin	18.83	20.91	23.37	30.94	23.51
Chicken Manure + Phosphrene	17.83	18.01	19.33	20.38	18.89
Chicken Manure + Serialin + Phosphorene	15.98	16.47	21.92	25.36	19.93
Pigeon dung + Serialin	9.83	12.44	17.49	23.15	15.73
Pigeon dung + Phosphrene	8.04	10.40	11.99	13.41	10.96
Pigeon dung + Serialin+ Phosphorene	9.21	11.26	15.83	20.75	14.26
Mean	17.93	20.06	23.40	28.55	
L.S.D	**NT 2.4071 NR 1.5224 NT×NR .8141**				

Table 8. Nitrogen uptake (mg pot^{-1}) by barley at booting stage as affected by organic and biofertilization under different levels of mineral-N

Mineral - N rates Nitrogen Sources	30 mg N kg $soil^{-1}$	60 mg N kg $soil^{-1}$	90 mg N kg $soil^{-1}$	120 mg N kg $soil^{-1}$	Mean
Mineral – N	7.76	9.94	13.86	12.64	11.05
Compost + Serialin	40.97	56.77	76.41	68.13	60.57
Compost + Phosphorene	13.83	22.63	60.14	46.62	35.81
Compost + Serialin+ Phosphorene	38.79	51.50	72.51	56.98	54.95
Chicken manure + Serialin	38.18	52.42	69.65	54.09	53.59
Chicken Manure + Phosphrene	11.83	17.75	56.24	24.82	27.66
Chicken Manure + Serialin + Phosphorene	19.74	21.61	53.55	28.67	30.89
Pigeon dung + Serialin	15.61	32.89	39.53	35.39	30.86
Pigeon dung + Phosphrene	9.82	11.34	19.70	19.01	14.97
Pigeon dung + Serialin+ Phosphorene	13.95	16.13	29.12	23.82	20.76
Mean	21.05	29.30	49.07	37.02	
L.S.D	**NT 3.0217 NR 1.9111 NT × NR 6.0435**				

Table 9. Nitrogen uptake (mg pot^{-1}) by barley straw as affected by organic and biofertilization under different levels of mineral-N

Mineral - N rates / Nitrogen Sources	30 mg N kg soil^{-1}	60 mg N kg soil^{-1}	90 mg N kg soil^{-1}	120 mg N kg soil^{-1}	Mean
Mineral – N	17.05	20.02	19.42	18.95	18.86
Compost + Serialin	22.98	34.09	32.94	25.97	29.00
Compost + Phosphorene	19.27	31.42	26.39	23.03	25.03
Compost + Serialin+ Phosphorene	20.83	32.64	29.01	22.42	26.23
Chicken manure + Serialin	23.84	46.29	39.41	36.07	36.40
Chicken Manure + Phosphrene	21.87	29.83	27.95	24.08	25.93
Chicken Manure + Serialin + Phosphorene	22.10	41.83	33.71	32.52	32.54
Pigeon dung + Serialin	21.99	29.32	29.22	23.94	26.12
Pigeon dung + Phosphrene	17.16	24.97	21.85	21.66	21.41
Pigeon dung + Serialin+ Phosphorene	22.14	26.82	24.43	22.48	23.97
Mean	20.92	31.72	28.43	25.11	
L.S.D	**NT 0.1426 NR 0.0902 NT ×NR 0.2853**				

Table 10. Nitrogen uptake (mg pot^{-1}) by barley grains as affected by organic and biofertilization under different levels of mineral-N

Mineral - N rates / Nitrogen Sources	30 mg N kg soil^{-1}	60 mg N kg soil^{-1}	90 mg N kg soil^{-1}	120 mg N kg soil^{-1}	Mean
Mineral – N	36.2	61.2	51.9	51.4	50.2
Compost + Serialin	77.8	171.3	167.8	105.5	130.6
Compost + Phosphorene	67.3	106.9	80.7	79.2	83.5
Compost + Serialin+ Phosphorene	70.1	131.2	120.4	81.7	100.9
Chicken manure + Serialin	91.2	267.3	136.4	125.1	155.0
Chicken Manure + Phosphrene	71.7	160.8	149.5	117.6	124.9
Chicken Manure + Serialin + Phosphorene	81.9	232.9	178.8	109.6	150.8
Pigeon dung + Serialin	65.2	217.8	112.4	76.1	117.9
Pigeon dung + Phosphrene	42.1	86.8	71.6	58.5	64.8
Pigeon dung + Serialin+ Phosphorene	47.2	79.6	72.7	61.1	65.2
Mean	65.1	151.6	114.2	86.6	
L.S.D	**NT 4.1539 NR 2.6271 NT ×NR 8.3077**				

Regarding the effect of organic and biofertilizers, data revealed that the N uptake by plant has significantly increased at all growth stages under study. According to **Haas and Défago (2005**), the explanation for higher nutrient uptake by plants treated with efficient bacteria is the creation of plant growth regulators by bacteria at the root interface, which stimulated root growth and facilitated better absorption of nutrients from the soil. According to **Richa *et al.* (2017),** the breakdown of organic matter increased the amount of total nitrogen in the soil, which increased crop uptake of nitrogen. According to **Aditi *et al.* (2019),** compost and biofertilizer have a positive impact on microbial activity and root growth in soil, which solubilizes native nutrients and increases plant concentration and availability of nitrogen. According to **Lamlom *et al.* (2023)**, applying humic acid and biofertilizer statistically increased the nitrogen content (2.09 and 2.11%).

Concerning the highest N uptake, at tillering stage, the highest value "54.10 mg pot^{-1}" was obtained under the treatment of "compost + serialin" at the addition level of 120 mg mineral N kg $soil^{-1}$ compared with "11.56 mg pot^{-1}" under the addition of individual mineral-N. Concerning the booting stage, the maximum value of N uptake "76.41 mg pot^{-1}" was observed under the treatment of "compost + serialin " at the addition level of 90 mg mineral N kg $soil^{-1}$ compared with "13.86 mg pot^{-1}" under the addition of individual mineral-N. Regarding the maturity stage, the maximum N uptake of straw and grains "46.29 and 267.3 mg pot^{1}, respectively" were recorded under the treatment of "chicken manure + serialin" at the addition level of 60 mg mineral N kg $soil^{-1}$ compared with 20.02 and 61.2 mg pot^{1} under the addition of greatest N contents of wheat grains were achieved when microbein was combined individual mineral-N. Regarding this aspect, **El-Sedfy (2002)** mentioned that the with compost. **Amin and Leitch (2009)** estimated the relative efficiency of organic manure on spring barley production, and they revealed that organic manure gave the highest values of total N content. According to **Zaghloul *et al.* (2010)**, the use of biofertilization produced the greatest N uptake records.

Phosphorus uptake

Regarding the effect of mineral nitrogen addition, data presented in Tables 11, 12, 13 and 14 shows that the individual addition of mineral nitrogen up to the level of 120 mg N Kg $soil^{-1}$ generally increased the P uptake; and this was found true at all growth stages under study. In this concern, **Amer (2005)** found that P uptake by wheat at booting and maturity stages increased with increasing fertilization up to 50.4 kg N ha-^{1} in normal soil. M**ohamed *et al.* (2006)** stated that the concentration and uptake of phosphorus in wheat grains increased with increasing N application rate up to 179 kg N ha^{-1}. According to research by **Antoun *et al.* (2010)**, increasing the amount of mineral nitrogen fertilizer from 10.5 to 21, 31.5, and 42 kg N ha^{-1} significantly increased the amount of P absorbed by wheat grains and straw. According to **Youssef *et al.* (2013)**, raising N up to 288 kg ha^{-1} considerably raised the P concentration in wheat grain and straw.

Concerning the highest P uptake, at tillering stage, the highest value "3.18 mg pot^{-1}" was obtained under the addition level of 120 mg N kg $soil^{-1}$; while the lowest value " 1.01 mg pot^{-1} " was obtained under the addition level of 30 mg N kg $soil^{-1}$. Regarding the booting stage, the highest P uptake "2.97 mg pot^{-1}" was recorded under the addition level of 90 mg N kg $soil^{-1}$; while the lowest value "1.31 mg pot^{-1}" was recorded under the addition level of 30 mg N kg $soil^{-1}$. Concerning the maturity stage, the highest P uptake of straw and grains "13.43 and 18.22 mg pot^{-1}, respectively" were observed under the addition level of 60 mg N kg $soil^{-1}$; while the lowest values "3.93 and 9.30 mg pot^{-1}" were observed under the addition level of 30 mg N kg $soil^{-1}$. The obtained results are compatible with those found by **El-Guibali (2016)** who observed that the administration of 42 kg N/ha resulted in the greatest content values for P absorption. **Itelima *et al.* (2018)** concluded that plants can utilize nutrients when bonded phosphorous was dissolved due to decreasing soil pH resulting from the acids produced by phosphate-solubilizing bacteria.

Regarding the effect of organic and biofertilizers, data shows that the P uptake by plant significantly increased at all growth stages

Table 11. Phosphorus uptake (mg pot^{-1}) by barley at tillering stage as affected by organic and biofertilization under different levels of mineral-N

Mineral - N rates Nitrogen Sources	30 mg N kg soil^{-1}	60 mg N kg soil^{-1}	90 mg N kg soil^{-1}	120 mg N kg soil^{-1}	Mean
Mineral – N	1.01	1.36	2.75	3.18	2.08
Compost + Serialin	3.65	4.23	5.83	7.60	5.33
Compost + Phosphorene	5.75	6.23	7.98	10.86	7.71
Compost + Serialin+ Phosphorene	3.92	6.02	7.86	8.46	6.57
Chicken manure + Serialin	3.08	3.51	3.57	4.40	3.64
Chicken Manure + Phosphrene	2.25	3.66	5.82	7.93	4.92
Chicken Manure + Serialin + Phosphorene	1.47	2.68	3.27	7.48	3.73
Pigeon dung + Serialin	1.32	1.64	2.92	3.88	2.44
Pigeon dung + Phosphrene	1.77	3.11	4.29	4.58	3.44
Pigeon dung + Serialin+ Phosphorene	1.63	2.81	3.37	4.32	3.03
Mean	2.59	3.53	4.77	6.27	
L.S.D	**NT 0.7376 NR 0.4665 NT × NR 1.4751**				

Table 12. Phosphorus uptake (mg pot^{-1}) by barley at booting stage as affected by organic and biofertilization under different levels of mineral-N

Mineral - N rates Nitrogen Sources	30 mg N kg soil^{-1}	60 mg N kg soil^{-1}	90 mg N kg soil^{-1}	120 mg N kg soil^{-1}	Mean
Mineral – N	1.31	1.32	2.97	2.92	2.13
Compost + Serialin	5.65	8.72	10.69	8.98	8.51
Compost + Phosphorene	7.14	8.76	18.58	12.60	11.77
Compost + Serialin+ Phosphorene	6.91	7.37	15.58	14.44	11.08
Chicken manure + Serialin	2.06	2.84	4.41	4.26	3.39
Chicken Manure + Phosphrene	3.01	7.86	16.19	9.16	9.06
Chicken Manure + Serialin + Phosphorene	3.42	4.42	14.25	11.77	8.47
Pigeon dung + Serialin	1.65	2.54	6.84	3.34	3.59
Pigeon dung + Phosphrene	2.21	2.90	9.87	4.79	4.94
Pigeon dung + Serialin+ Phosphorene	3.18	3.97	10.42	6.92	6.12
Mean	3.65	5.1	10.98	7.92	
L.S.D	**NT 0.9445 NR 0.5973 NT×NR 1.8889**				

Table 13. Phosphorus uptake (mg pot^{-1}) by barley straw as affected by organic and biofertilization under different levels of mineral-N

Mineral - N rates / Nitrogen Sources	30 mg N kg soil^{-1}	60 mg N kg soil^{-1}	90 mg N kg soil^{-1}	120 mg N kg soil^{-1}	Mean
Mineral – N	3.93	13.34	11.56	9.85	9.67
Compost + Serialin	5.62	38.49	17.16	12.23	18.38
Compost + Phosphorene	15.31	39.23	22.14	16.41	23.27
Compost + Serialin+ Phosphorene	9.21	35.81	31.38	13.84	22.56
Chicken manure + Serialin	11.29	34.37	15.35	13.45	18.62
Chicken Manure + Phosphrene	12.89	40.97	38.37	27.91	30.04
Chicken Manure + Serialin + Phosphorene	11.31	37.41	34.36	14.64	24.43
Pigeon dung + Serialin	4.49	18.58	18.17	13.74	13.75
Pigeon dung + Phosphrene	7.06	39.78	19.67	14.65	20.29
Pigeon dung + Serialin+ Phosphorene	10.08	23.21	22.36	15.94	17.90
Mean	9.12	32.12	23.05	15.27	
L.S.D	**NT 1.3731 NR 0.8684 NT × NR 2.7461**				

Table 14. Phosphorus uptake (mg pot^{-1}) by barley grains as affected by organic and biofertilization under different levels of mineral-N

Mineral - N rates / Nitrogen Sources	30 mg N kg soil^{-1}	60 mg N kg soil^{-1}	90 mg N kg soil^{-1}	120 mg N kg soil^{-1}	Mean
Mineral – N	9.30	18.22	14.41	13.43	13.84
Compost + Serialin	14.72	26.71	19.62	18.23	19.82
Compost + Phosphorene	18.53	49.60	38.62	19.11	31.47
Compost + Serialin+ Phosphorene	14.81	30.42	25.50	24.73	23.87
Chicken manure + Serialin	12.92	41.43	30.61	19.82	26.19
Chicken Manure + Phosphrene	20.13	65.12	42.21	30.71	39.54
Chicken Manure + Serialin + Phosphorene	17.70	48.31	39.52	21.63	31.79
Pigeon dung + Serialin	11.64	20.72	16.51	14.22	15.77
Pigeon dung + Phosphrene	19.61	29.34	25.73	22.62	24.33
Pigeon dung + Serialin+ Phosphorene	14.83	21.41	17.62	15.24	17.28
Mean	15.42	35.13	27.04	19.97	
L.S.D	**NT 2.6311 NR 1.6641 NT × NR 5.2623**				

under study. In this aspect, **Nautiyal *et al.* (2000)** concluded that a variety of soil microorganisms may be able to solubilize unavailable forms of calcium bound through their metabolic processes by excreting organic acids that dissolve chelated calcium ions directly and put P into solution. **Behera and Singh (2010)** found that the beneficial effects of inoculants and organic manure decreased phosphorus fixation by causing the chelating effect of micronutrients, which likely increases phosphorus availability, and by releasing significant amounts of variable organic acids during the decomposition process. According to **El-Guibali (2016)**, applying 4.2 m3 of compost ha^{-1} considerably raised the P concentrations in the wheat plants' grains and straw. According to **Kumar *et al.* (2017),** inoculation with PGPR enhanced P absorption in wheat grains and straw by up to 118% and 83%, respectively, compared to untreated controls. According to **Farrag and Baker (2021)**, the addition of organic amendments raised the plants' metabolic activity and caused metabolites to migrate from the roots and stems toward the leaves, increasing the amount of P in the leaves and stems.

Concerning the highest P uptake, at tillering stage, the highest value "10.86 mg pot^{-1}" was observed under the treatment of "compost + phosphorine" at the addition level of 120 mg mineral N kg soil compared with "3.18 mg pot^{-1}" under the addition of individual mineral-N. Concerning the booting stage, the maximum value of P uptake "18.58 mg pot^{-1}" was obtained under the treatment of " compost + phosphorine" at the addition level of 90 mg mineral N kg $soil^{-1}$ compared with "2.97 mg pot^{-1}" under the addition of individual mineral-N. Regarding the maturity stage, the maximum P uptake of straw and grains "40.97 and 65.12 mg pot^{-1}, respectively" were recorded under the treatment of "chicken manure + phosphorine" at the addition level of 60 mg mineral N kg $soil^{-1}$ compared with "13.34 and 18.22mg pot^{-1}" under the addition of individual mineral-N. The observed results agree with **Neeru *et al.* (2000)** who noted that inoculation of wheat varieties with *Azotobacter* showed greater P uptake. **El-Sedfy (2002)** mentioned that the greatest P contents of wheat grains were achieved when microbein was combined with compost. According to **Mustafa *et al.* (2006),** the Bacillus inoculation of barley greatly raised the P concentration in the plants. Barley's increased total P absorption suggested that Bacillus may solubilize P. **Cathy *et al.* (2019)** stated that P concentrations in straw and grains had increased significantly in the crop receiving straw amendment compared to the control**.**

Potassium uptake

Concerning the effect of mineral nitrogen addition, data presented in Tables 15, 16, 17 and 18 indicates that the individual addition of mineral nitrogen up to the level of 120 mg N Kg $soil^{-1}$ generally increased the K uptake; and this was found to be true at all growth stages under study. In this concern, **Amer (2005)** found that potassium uptake by wheat at booting and maturity stages increased with increasing fertilization up to 50.4 kg N ha^{-1}. **Mohamed *et al.* (2006)** noticed that the uptake of K in wheat grains increased with increasing nitrogen applications rate from 107 up to 179 kg N ha^{-1}. According to **Antoun *et al.* (2010)**, there was a considerable increase in the K uptake of grains and straw wheat plants when the mineral nitrogen fertilizer amount was increased from 10.5 to 21, 31.5 and 42 kg N ha^{-1}.

Regarding the highest K uptake, at tillering and booting stages, the highest values "9.2 and 13.7 mg pot^{-1}, respectively" were observed under the addition level of 120 mg N kg $soil^{-1}$; while the lowest values " 5.1 and 6.6 mg pot^{-1} " were observed under the addition level of 30 mg N kg $soil^{-1}$. However, at maturity stage, the highest K uptake of straw and grains "25.01 and 39.2 mg pot^{-1}, respectively" were obtained at the addition level of 90 mg N kg^{-1} soil, while the lowest values "12.92 and 26.2pot^{-1}" were obtained under the addition level of 30 mg N kg $soil^{-1}$. The obtained results are compatible with that found by **El-Barbary (1998)** who studied the effect of applying N fertilizer starting from 8.4 up to 29.4 kg N ha^{-1}, and obtained greater concentration value of K in grains of wheat. According to **Youssef *et al.* (2011),** wheat grains' uptake of potassium increased noticeably as N levels rose, reaching its maximum at 37.8 kg N ha^{-1}, with grains absorbing 7.14 kg K ha^{-1}. According to **El-Guibali (2016)**, using 42 kg N/ha resulted in the greatest content values for K absorption.

Table 15. Potassium uptake (mg pot^{-1}) by barley at tillering stage as affected by organic and biofertilization under different levels of mineral-N

Mineral - N rates / Nitrogen Sources	30 mg N kg soil^{-1}	60 mg N kg soil^{-1}	90 mg N kg soil^{-1}	120 mg N kg soil^{-1}	Mean
Mineral – N	5.1	7.3	8.6	9.2	7.6
Compost + Serialin	10.7	64.3	77.6	52.2	51.2
Compost + Phosphorene	17.7	34.3	35.3	55.7	35.8
Compost + Serialin+ Phosphorene	12.2	53.6	57.4	94.3	54.4
Chicken manure + Serialin	15.8	27.4	31.1	38.6	28.2
Chicken Manure + Phosphrene	10.9	13. 5	17.0	42.0	20.9
Chicken Manure + Serialin + Phosphorene	9.6	29.8	37.1	59.2	34.4
Pigeon dung + Serialin	9.8	12.7	16.8	18.5	14.5
Pigeon dung + Phosphrene	7.7	11.4	12.6	15.1	11.9
Pigeon dung + Serialin+ Phosphorene	12.6	14.8	21.8	27.4	19.2
Mean	11.2	26.9	31.5	41.2	
L.S.D	**NT 0.9107 NR 0.5760 NT × NR 1.8213**				

Table 16. Potassium uptake (mg pot^{-1}) by barley at booting stage as affected by organic and biofertilization under different levels of mineral-N

Mineral - N rates / Nitrogen Sources	30 mg N kg soil^{-1}	60 mg N kg soil^{-1}	90 mg N kg soil^{-1}	120 mg N kg soil^{-1}	Mean
Mineral – N	6.6	10.5	13.2	13.7	11.0
Compost + Serialin	43.9	45.5	48.6	53.3	47.8
Compost + Phosphorene	41.8	44.3	46.8	48.0	45.2
Compost + Serialin+ Phosphorene	30.9	81.4	87.3	105.5	76.3
Chicken manure + Serialin	44.2	47.6	50.2	53.1	48.8
Chicken Manure + Phosphrene	14.6	19.2	21.9	29.2	21.2
Chicken Manure + Serialin + Phosphorene	11.3	20.8	47.9	53.8	33.5
Pigeon dung + Serialin	13.4	14.9	15.2	23.7	16.8
Pigeon dung + Phosphrene	8.3	11.7	14.4	21.6	14.0
Pigeon dung + Serialin+ Phosphorene	13.5	16.4	30.2	40.1	25.1
Mean	20.9	31.2	37.6	44.2	
L.S.D	**NT 1.2081 NR 0.7641 NT × NR 2.4163**				

Table 17. Potassium uptake (mg pot^{-1}) by barley straw as affected by organic and biofertilization under different levels of mineral-N

Mineral - N rates / Nitrogen Sources	30 mg N kg soil^{-1}	60 mg N kg soil^{-1}	90 mg N kg soil^{-1}	120 mg N kg soil^{-1}	Mean
Mineral – N	12.92	21.46	25.01	18.92	19.58
Compost + Serialin	17.98	30.56	45.78	25.04	29.84
Compost + Phosphorene	27.64	30.67	32.81	27.64	29.69
Compost + Serialin+ Phosphorene	28.61	42.83	49.36	35.73	39.13
Chicken manure + Serialin	35.46	63.48	79.68	55.41	58.51
Chicken Manure + Phosphrene	33.54	39.86	37.69	35.34	36.61
Chicken Manure + Serialin + Phosphorene	28.08	58.05	66.97	36.23	47.33
Pigeon dung + Serialin	16.17	25.83	27.62	22.76	23.10
Pigeon dung + Phosphrene	15.53	23.81	26.28	20.62	21.56
Pigeon dung + Serialin+ Phosphorene	21.92	30.28	40.21	30.17	30.65
Mean	23.79	36.68	43.14	30.79	
L.S.D	**NT 0.4599 NR 0.2909 NT × NR 0.9198**				

Table 18. Potassium uptake (mg pot^{-1}) by barley grains as affected by organic and biofertilization under different levels of mineral-N

Mineral - N rates / Nitrogen Sources	30 mg N kg soil^{-1}	60 mg N kg soil^{-1}	90 mg N kg soil^{-1}	120 mg N kg soil^{-1}	Mean
Mineral – N	26.2	36.6	39.2	32.6	33.7
Compost + Serialin	43.3	52.2	108.9	45.4	62.5
Compost + Phosphorene	39.6	43.8	47.2	42.7	43.3
Compost + Serialin+ Phosphorene	53.7	86.3	105.4	67.2	78.2
Chicken manure + Serialin	55.1	96.7	151.9	77.1	95.2
Chicken Manure + Phosphrene	33.4	54.7	56.7	37.6	45.6
Chicken Manure + Serialin + Phosphorene	51.5	85.1	136.6	60.8	83.5
Pigeon dung + Serialin	30.8	43.5	60.4	36.7	42.9
Pigeon dung + Phosphrene	28.5	41.5	46.3	35.6	38.0
Pigeon dung + Serialin+ Phosphorene	35.6	58.1	82.7	50.6	56.8
Mean	39.8	59.9	83.5	48.6	
L.S.D	**NT 1.2955 NR 0.8194 NT × NR 2.5910**				

Concerning the effect of organic and biofertilizers, data shows that the K uptake by plant significantly increased at all growth stages under study. In this aspect, **Waddington (1998)** noted that the suitability and usefulness of organic fertilizers has been attributed to the high availability of K content, which can enhance soil fertility and increase K uptake by plants. **Abdel-Latif *et al.* (2001)** noted that free living nitrogen fixing bacteria has the ability not only to fix nitrogen but also to release certain phytohormones which could increase the availability of K for plant roots by increasing their dissolution. **El-Guibali (2016)** reported that the application of 4.2 m^3 compost ha^{-1} significantly increased K contents in the grains and straw of wheat plants. **Lamlom *et al.* (2023)** revealed that the application of biofertilizer and humic acid statistically increased potassium content by 1.73 and 1.76%, respectively for two growth seasons.

Regarding the highest K uptake, at tillering and booting stages, the highest values "94.3 and 105.5 mg pot^{-1}, respectively" were observed under the treatment of "compost + serialin + phosphorine" at the addition level of 120 mg mineral N kg $soil^{-1}$ compared with 9.2 and 13.7 mg pot^{-1} under the addition of individual mineral-N. Regarding the maturity stage, the maximum K uptake of straw and grains were 79.68 and 151.9 mg pot^{-1}, respectively and were obtained under the treatment of "chicken manure + serialin" at the addition level of 90 mg mineral N kg $soil^{-1}$ compared with 25.01 and 39.2 mg pot^{-1} under the addition of individual mineral-N. The observed results agree with **Neeru *et al.* (2000)** who discovered that inoculating wheat types with soil isolates and mutant strains of Azotobacter resulted in increased K absorption. **El-Sedfy (2002)** mentioned that the greatest K contents of wheat grains were achieved when microbein was combined with compost.

Yield Productivity and Quality of Barley as Affected by Organic and Biofertilization under Different Levels of Mineral-N

Grains yield

Concerning the effect of mineral nitrogen addition, data presented in Table 19 shows that the individual addition of mineral nitrogen up to the level of 120 mg N Kg $soil^{-1}$ generally increased the grains yield. The outcomes support the findings of **Gazia and Abd ElAziz (2013)**, who found that raising the nitrogen content to 37.8 kg ha^{-1} significantly increased the yield of wheat grains. According to **Kousar *et al.* (2015)**, adding 120 or 150 kg N ha^{-1} greatly enhanced wheat grain output. According to **Fadel *et al.* (2016),** grain yield fed^{-1} was greatly boosted by raising the nitrogen fertilizer amount to 50.4 kg ha^{-1} observed that the greatest N rate of 3.93 tons per hectare was required to get the maximum yield of wheat, which was 93.8 kg N ha^{-1}. According to **Szmigiel *et al*. (2014),** the addition level of 90 kg N ha^{-1} produced the highest wheat grain production.

Regarding the maximum grains yield, the highest value "5.46 g pot^{-1}" was obtained under the addition level of 60 mg N kg $soil^{-1}$; while the lowest value "3.17 g pot^{-1}" was obtained under the addition level of 30 mg N kg $soil^{-1}$. **Boukef *et al.* (2013)** (4.51 tons ha^{-1}). According to **Kousar *et al.* (2015)**, adding 120 or 150 kg N ha^{-1} greatly enhanced wheat grain output. The rate of 150 kg N ha^{-1} produced the highest grain yield. **Sugar *et al.* (2016)** investigated the effects of nitrogen fertilizer levels on wheat (0, 80, 160, and 240 kg N ha^{-1}) and discovered that 80 and 160 kg N ha^{-1} produced the highest grain yield but the higher N rate did not lead to further yield increase.

Concerning the effect of organic and biofertilizers, the results indicate a significant improvement in grain yield in relation to the application of organic and biofertilizers. According to **Metin *et al.* (2010)**, the use of biofertilizers increased crop yield and reduced farming expenses by giving crops readily available nutrients and growth-promoting agents. According to **Davari *et al.* (2012),** the application of FYM raised grain yields by 22% and 64%, respectively, in the first and second years, as compared to the control. According to **Umesha *et al.* (2014),** the reason for the highest grain weight could be attributed to the beneficial effects of biofertilizers and organic fertilizers on improved root development, which increased nutrient uptake.

Regarding the maximum grains yield, the highest value "10.08 g pot^{-1}" was observed under the treatment of "chicken manure + serialin" at

Table 19. Grains yield (g pot^{-1}) of barely as affected by organic and biofertilization under different levels of mineral-N

Mineral - N rates / Nitrogen Sources	30 mg N kg soil^{-1}	60 mg N kg soil^{-1}	90 mg N kg soil^{-1}	120 mg N kg soil^{-1}	Mean
Mineral – N	3.17	5.46	4.86	4.59	4.52
Compost + Serialin	4.17	9.29	7.20	6.85	6.88
Compost + Phosphorene	5.59	7.22	6.75	6.17	6.43
Compost + Serialin+ Phosphorene	5.58	7.31	6.75	6.16	6.45
Chicken manure + Serialin	5.57	10.08	8.82	7.79	8.07
Chicken Manure + Phosphrene	5.57	7.38	6.76	6.37	6.52
Chicken Manure + Serialin + Phosphorene	4.76	9.42	7.50	7.30	7.25
Pigeon dung + Serialin	5.59	7.31	6.73	6.28	6.48
Pigeon dung + Phosphrene	3.89	5.48	5.04	4.76	4.79
Pigeon dung + Serialin+ Phosphorene	4.18	5.51	5.05	4.66	4.85
Mean	4.81	7.45	6.55	6.09	
L.S.D	**NT 51.948 NR 32.855 NT×NR 103.90**				

the addition level of 60 mg mineral N kg soil^{-1} compared with "5.46 g pot^{-1}" under the addition of individual mineral-N. According to **Matter *et al.* (2007)**, using organic fertilizers enhanced wheat grain output. The treatment involving farmyard manure, chicken dung, and compost yielded the best grain yield, at 0.5: 0.28: 0.63 tons ha^{-1}. The fertilizer used for plants was 30 mg of compost ha^{-1}. **Ali *et al.* (2017)** discovered that fertilization treatments had a substantial impact on grain output and suggested treating with 50% mineral nitrogen with biofertilizer "serialin" to get the highest possible values of grain yield.

Protein content in grains

Regarding the effect of mineral nitrogen addition, data presented in Table 20 indicates that the individual addition of mineral nitrogen up to the level of 120 mg N Kg soil^{-1} significantly increased the protein content of grains. According to **Antoun *et al.* (2010)**, there was a considerable increase in grain protein content when the amount of mineral nitrogen fertilizer added to wheat was increased from 10.5 to 21, 31.5, and 42 kg N ha^{-1}. According to **Seleiman *et al.* (2021),** nitrogen may have an impact on protein percentage since it is a necessary component of amino acid molecules, which means that it is crucial for protein synthesis. A high nitrogen supply promotes the conversion of carbohydrates into protein, according to **Tehulie and Eskezia (2021)**.

Concerning the protein content in grains, the highest value "349 mg pot^{-1}" was observed under the addition level of 60 mg N kg soil^{-1}; while the lowest value "206 mg pot^{-1}" was obtained under the addition level of 30 mg N kg soil^{-1}. The obtained results fertilizer at a rate of 100 kg N ha^{-1} could result in seeds with a higher protein content.

Allam (2005) investigated how various nitrogen fertilization amounts (30, 60, 90, and 50.4 kg N ha-1) affected certain wheat cultivars. Protein percentage was best achieved with nitrogen fertilizer at a level of 37.8 kg N ha^{-1}. According to **Tababtabaei and Ranjbar (2012)**, applying 160 kg N ha^{-1} to wheat produced the maximum grain protein content.

Regarding the effect of organic and biofertilizers, data indicates a notable increase in the protein content of cereals. The explanation for the increased protein content of grains after adding organic and biofertilizers is that these

Table 20. Yield quality* (mg pot^{-1}) of barley grains as affected by organic and biofertilization under different levels of mineral-N

Mineral - N rates / Nitrogen Sources	30 mg N kg soil^{-1}	60 mg N kg soil^{-1}	90 mg N kg soil^{-1}	120 mg N kg soil^{-1}	Mean
Mineral – N	206	349	296	293	286
Compost + Serialin	444	976	957	601	745
Compost + Phosphorene	384	609	460	452	476
Compost + Serialin+ Phosphorene	400	748	686	466	575
Chicken manure + Serialin	520	1524	778	713	884
Chicken Manure + Phosphrene	409	917	852	670	712
Chicken Manure + Serialin + Phosphorene	467	1328	1019	625	860
Pigeon dung + Serialin	372	1241	641	434	672
Pigeon dung + Phosphrene	240	495	408	334	369
Pigeon dung + Serialin+ Phosphorene	269	453	414	348	371
Mean	371	864	651	494	
L.S.D	**NT 23.677 NR 14.975 NT×NR 47.354**				

*protein content "Grains N content x5.7"

fertilizers may be able to enhance grain quality by promoting photosynthesis and nutrient uptake, which in turn translocate to the seed and enhance grain protein.

Regarding this, **Canhong *et al.* (2020)** found that the combination of the organic and biofertilizers improved the uptake of nutrients, particularly N content, which may help raise the amount of amino acids and, consequently, protein in grains. According to **Madhurya *et al.* (2021)**, applying inorganic, organic, and biofertilizers imultaneously increased soil N availability and, consequently, crop N uptake which is the primary source of protein content.

Concerning the protein content in grains, the treatment of "chicken manure + serialin" at the addition level of 60 mg mineral N kg soil^{-1} produced the highest value ("1524 mg pot^{-1}") as compared to "349 mg pot^{-1}" with the addition of individual mineral-N. The results obtained are consistent with those of **Ravindra *et al.* (2002)**, who found that the addition of farmyard manure at 10 tons per hectare boosted wheat grain's protein content by 1.48 percent and 2.59 percent, respectively. **Abedi *et al.* (2010)** investigated how various amounts of organic fertilizer affected wheat. They discovered that employing 60 Mg of compost ha^{-1} generated the seeds with the highest protein content. According to **Tayebeh (2010)**, applying compost had a major impact on seed protein content, with 60 mg of compost applied ha^{-1} showing the highest seed protein concentration.

REFERENCES

Abad, A., J. Lloveras and A. Michelena (2004). Nitrogen fertilization and foliar urea effects on durum wheat yield and quality and residual soil nitrate in irrigated Mediterranean conditions. Field Crop Res., 87 (2-3): 257-269.

Abdel-Latif, M.R., A.A. El-Bana and A.A. Galal (2001). Effect of biofertilizers Microbein and Phosphorine on bacterial pod blight of guar and black cumin damping off root rot and with diseases. Proc. of 5th Arab. Hort. Conf., Ismailia, Egypt, 24-28 : 133- 140.

Abedi, T., A. Alemzadeh and S.A. Kazemeini (2010). Effect of organic and inorganic fertilizers on grain and protein banding pattern of wheat. Aust. J. Crop Sci., 4 (6): 384 - 389.

Abu-Grab, O.S., A.M. Moussa and G.A. El-Shaarawy (2006). Photosynthetic and N-use efficiencies for some wheat cultivars in relation to planting density and nitrogen fertilization level. Egypt. J. Appl. Sci., 21 (2B): 475-492.

Achari, K.S.S., S. Singh and S.A. Khan (2021). Effect of biofertilizers and nitrogen levels on growth and yield of wheat (*Triticum aestivum* L.). The Pharma Innovation J., 10 (10): 1979-1982.

Aditi, C., S. Tripathi, S. Govind and N. Singh (2019). Effect of Fertilizer Levels, Biocompost and Biofertilizer on Content and Uptake of Nutrients of Fodder Sorghum (*Sorghum bicolor* (L.) Moench). Int. J. Current Microbiol. and Appl. Sci., 8 (10): 1130-1136.

Allam, S.A. (2005). Growth and productivity performance of some wheat cultivars under various nitrogen fertilization levels. J. Agric. Sci. Mansoura Univ., 30 (4): 1971-1980.

Amer, A.M.M. (2005). Effect of N, K levels, and timing of application on some yield components of wheat varieties in the North Middle Delta region. M.Sc. Thesis, Fac. Agric., Tanta Univ., Kafr El-Sheikh. Egypt.

Amin, O.J. and M. Leitch (2009). Relative efficacy of organic manure in spring barley (*Hordeum Vulgara* L.) production. Aust. J. Crop Sci., 3: 13 - 19.

Antoun, L.W., S.M. Zakaria and H.H. Rafla (2010). Influence of compost, N-mineral and humic acid on yield and chemical composition of wheat plants. J. Soil Sci. and Agric. Engi., Mansoura Univ., 1(11): 1131-1143.

Ayadi, S., C. Karmous, Z. Hammami, Y. Trifa and S. Rezgui (2014). Variation of durum wheat yield and nitrogen use efficiency under mediterranean rainfed environment. Int. J. Agri. Crop Sci., 7 (10): 693-699.

Aziz, T., S. Ullah, A. Sattar, M. Nasim, M. Farooq and M.M. Khan (2010). Nutrient availability and maize (*Zea mays*, L.) growth in soil amended with organic manures. Int. J. Agric. Biol., 12: 621-624.

Basyouny, E.A. (2001). Plant response to fertilization in relation to micronutrietns status in plant and soil. Ph.D. Thesis, Fac. Agric., Ain Shams Univ., Egypt.

Behera, S.K. and D. Singh (2010). Effect of 31 years of continues cropping and fertilizer use on soil properties and uptake of micronutrients by maize (*Zea mays* L.) wheat (*Triticum aestivum*) system. Indian J. Agric. Sci., 79: 264-267.

Bishni, U.R. and I.L. Hughes (1979). Agronomic performance and protein content of fall-planted tritica wheat, and rye. Agron. J., 71: 359 -360.

Black, C.A. (1982). Methods of Soil Analysis. Ame. Soc. Agro. Madison, Wisconsin, USA.

Borham, M.M.E. (2008). Agronomic studies on wheat under newly reclaimed soil conditions. M. Sc. Thesis, Fac. Agric. Mansoura Univ., Egypt.

Boukef, S., C. Karmous, Y. Trifa and S. Rezgui (2013). Durum wheat grain quality traits as affected by nitrogen fertilization sources under Mediterranean rain fed conditions. J. Agri. and Sust. , 4 (1): 99-114.

Brown, J.D. and O. Lilliand (1964). Rabid determination of potassium and sodium in plant material and soil extracts by flame photometry. Proc. Amer. Soc. Hort. Sci., 48: 341 - 346.

Canhong, G., A.M. El-Sawah, F.I. Ali-Dina, Y. Alhaj, H. Shaghaleh-Hiba and M.S. Sheteiwy (2020). The integration of bio and organic fertilizers improve plant growth, grain yield, quality and metabolism of hybrid maize (*Zea mays* L.). Agronomy, 10: 319. doi: 10.3390/ agronomy10030319.www. mdpi.com/ journal / agronomy.

Cathy, L.T., G.E. Acquah, A.P. Whitmore, S.P. M. Grath and S. Haefele (2019). The effect of different organic fertilizers on yield and soil and crop nutrient concentrations. Agron., 9: 776. doi: 10. 33901 - 9120776.

Chapman, H.D. and P.F. Pratt (1978). Methods of Analysis for Soils, Plants and Waters. California Div. Univ., Agric. Sci., Priced Publication, 4034: 50 and 169.

Davari, M.R., S.N. Sharma and M. Mirzakhani (2012). The effect of combinations of organic materials and biofertilizers on productivity, grain quality, nutrient uptake, and economics of organic farming of wheat. J. Organic Systems, 7(2):28 ISSN1177-4258.

El-Barbary, S.M. (1998). Effect of drought conditions and nitrogen fertilization levels on wheat yield and its water relations. J. Agric. Sci. Mansoura Univ., 23(2):207-217.

El-Guibali, A.H. (2016). Effect of organic and mineral fertilization on wheat yield and quality. J. Soil Sci. and Agric. Eng., Mansoura Univ., 7(11): 829 - 836, 2016.

El-Hamdi, K.H., A.R. Ahmed and N.E.S. El-Azzony (2012). Effect of compost, nitrogen and micronutrient compounds on nitrogen uptake, yield and yield components of wheat. J. Soil Sci. and Agric. Eng., Mansoura Univ., 3 (11): 1043 – 1056.

El-Sedfy, O.F. (2002). Effect of bentonite, compost and biofertilizer additions on some physical properties of sandy soil and wheat and peanut yields. J. Agric. Sci. Mansoura Univ., 27:7117-7126.

Fadel, A.A.H., A.Y.A. El-Bana, A. Omar and M.E.I. Abdul Hamid (2016). Response of some wheat cultivars to varying sowing dates and nitrogen fertilizer levels under sandy soil condition. Zagazig J. Agric Res., 43(1): 29-48.

Faizy, S.E.A., M.M. Rizk, M.M. Ragab and M. M.A. Amer (2010). Response of wheat yield and apparent nitrogen recovery of fertilizer to mineral nitrogen and biofertilizer application in salt affected soils. J. Agric. Res. Kafr El-Sheikh Univ., 36 (1).

Farrag, H.M. and A.A. Bakr-Abeer (2021). Biological reclamation of a calcareous sandy soil with improving wheat growth using farmyard manure, acid producing bacteria and yeast. SVU-Int. J. Agric. Sci., 3 (1): 53-71.

Fuehring, H.D. (1973). Effect of antitranspirants on yield of grain sorghum under limited irrigation. Agron., 65 (3): 348-351.

Gazia, E.A.E. and M.A. Abd El-Aziz (2013). Maximizing wheat yield under N, K and B fertilization. J. Soil Sci. and Agric. Eng., Mansoura Univ., 4 (10): 1073 – 1084.

Gupta, M., N. Abu-Ghannam and E. Gallaghar (2010). Barley for brewing: characteristic changes during malting, brewing and applications of its by products, comprehensive reviews in food science and food safety. J. Inst. Food Technol., 9:318-328.

Haas, D. and G. Defago (2005). Biological control of soil-borne pathogens by fluorescent pseudomonads. Nature Rev. Microbiol., 3: 307 -319.

Ali, H.G., S.I. Abbas and A.A. Badawy (2017). Barley productivity and protein content as effected by fertilization treatments under calcareous soil conditions, 62 (3): 319-328.

Hesse, P.R. (1971). A Text Book of Soil Chemical Analysis. Joon Murry (Publishers) Ltd, 50 Albemarle Street, London.

IFIA (2000). Mineral fertilizer use and the environment. International Fertilizer Industry Association. Revised Edition. Paris, 53.

Itelima, J.U., W.J. Bang, M.D. Sila, I.A. Onyimba and O.J. Egbere (2018). A review: Biofertilizer A key player in enhancing soil fertility and crop Productivity. Microb. Biotechnol. Rep., 2 : 1.

Jackson, M.L. (1973). Soil Chemical Analysis. Prentice Hall, Ic., Englewood Califfs, New Jersy.

John, M.K. (1970). Colourimetrically determination of phorphrous in soil and plant materials with ascorbic acid. Soil Sci., 109: 214-220.

Kaur, S. and M. Das (2015). Nutritional and functional characterization of barley flaxseed based functional dry soup mix. J. Food Sc. Tiechnol., 52(9): 5510-5521.

Koriem, M.H.M. (2008). Response of some wheat cultivars to nitrogen and biofertilization. Ph. D Thesis Fac. Agric., Kafr El Sheikh. Univ., Egypt.

Kousar, P., L. Ali, A. Raza, A. Maqbool, S. Maqbool, S. Rasheed and N. Irum (2015). Effect of different levels of nitrogen on the economic yield of Wheat (*Triticum oestitum* L.) Variety Aas-11. Int. J. Agron. and Agric. Res., 6 (3): 7-11.

Kumar, A., B.R. Maurya, R. Raghuwanshi, V.S. Meena and M.T. Islam (2017). Co-inoculation with *Enterobacter* and Rhizobacteria on yield and nutrient uptake by wheat (*Triticum aestivum* l.) in the alluvial soil under indo-gangetic plain of India. J. Plant Growth Regul., 36:608–617 DOI 10.1007/s00344-016 -9663-5.

Lamlom, S.F., A. Irshad and W.F.A. Mosa (2023). The biological and biochemical composition of wheat (*Triticum aestivum*) as affected by the bio and organic fertilizers. BMC Plant Biol., 23:111.

Madhurya, P., M. Latha, C.S. Rao and S.P. Sree (2021). Effect of integrated use of inorganic fertilisers, organic manure and biofertilizers on quality of maize. The Pharm. Innovation J., 10 (11): 83-87.

Mahmoud, A.R., M.M. Hafez and F.S. Abd-Elal (2004). Comparative study for using organic manure as individual and/or mixing it with chemical fertilizer and their effects on the productivity of Vicia faba plants. J. Agric. Sci. Mansoura Univ., 29 (3): 1345 – 1354.

Martin, R.C. and R. MacRae (2014). Managing energy, nutrients, and pests in organic field crops. Boca Raton: CRC Press.

Matter, K.M., K.F. Moussa, S.A.H. El-Naka and M.A. Ali (2007).Effect of some soil organic amendments on the productivity of sandy soil. Zagazig J. Agric Res., 34 (2): 225-247.

Metin, T., M. Gulluce, R. Cakmakci, T. Oztas and F. Sahin (2010). The effect of PGPR strain on wheat yield and quality parameters. World Congress of soil Science, soil Solutions for a Changing World 1-6 August, Brisbane, Aust. Published on DVD.

Mohamed, M.R.M., A.A. Haggag and H.Z. Abd El-Salam (2006). Effect of nitrogen fertilization with calcium and magnesium application on growth, yield and nutrients content of wheat plant. J. Agric. Sci. Mansoura Univ., 31 (3): 1753-1760.

Mohammed, S.S. (2002) Integrated nitrogen management to wheat through mineral and biofertilization along with organic municipal wastes in some newly reclaimed soils of Egypt. Zagazig J. Agric. Res., 29 (2): 547-567.

Mosaad, I.S.M., E.E.E. Khafagy and R.A. El-Dissoky (2013). Effect of mineral, bio and organic nitrogen fertilization on wheat yield and nitrogen utilization efficiency and uptake at northern delta of Egypt. J. Soil Sci. and Agric. Eng., Mansoura Univ., 4 (10): 1101 – 1116.

Mostafa, M.M. (2001). Nutrients uptake and dry matter yield of barley as affected by salinity of irrigation water and addition of organic materials. Zagazig. J. Agri. Res., 28:533-552.

MSTAT-C (1991). A micro computer program for the design, Management and Analysis of Agronomic research experiment. MSTAT Dev. Team, Michign State Univ.

Muhammad, D. and R.A. Khattab (2009). Growth and nutrient concentration of maize in pressmud treated saline-sodic soils. Soil Environ., 28: 145-155.

Mustafa, Y.C., S. Bilen, R. Çakmakçi, F. Şahin and A. Aydın (2006). Effect of plant growth-promoting bacteria and soil compaction on barley seedling growth, nutrient uptake, soil properties and *Rhizosphere microflora*. Biol. Fertil. Soils, 42: 350-357.

Nautiyal, CS; Bhadauria S; Kumar P; Lal H; Mondal R and Verma D (2000) .Stress induced phosphate solubilization in bacteria isolated from alkaline soils. FEMS Microbiol. Lett, 182: 291-296.

Neeru, N., K. Vivek, K. Rishi, D. Annettee, G. Andreas and M. Wolfgana (2000). Effect of P-solubilizing *Azotobacter chroococcum* on N,P,K uptake in responsive wheat genotypes grown under greenhouse conditions. J. Plant. Nut. and Soil Sci., 163 (4): 393-398.

Olsen, S.R. and L.E. Sommers (1982). Methods of Soil Analysis. Part2: Chemical and

Microbiological properties. Am. Soc. Agron., Inc. Madison, Wis, USA.

Page, A.L., R.H. Miller and D.R. Keeney (1982). Methods of Chemical Analysis. Part 2: Chemical and microbiological properties (2nd Ed.). Ame. Soc. Agron., Inc. and Sci. Soc. Ame., Inc. Publishers, Madison, Wisconsin U.S.A.

Ravindra, S., S.K. Agarwal and M.L. Jat (2002). Quality of wheat (*Triticum aestivum* L.) and nutrient status in soil as influenced by organic and inorganic sources of nutrients. Indian J. Agric. Sci., 72 (8): 456-460.

Richa, K., S. Kumar, R. Kumar, A. Das, R. Kumari, C.D. Choudhary and R.P. Sharma (2017). Effect of long-term integrated nutrient management on crop yield, nutrition and soil fertility under rice-wheat system. J. Appl. and Nat. Sci., 9 (3): 1801–1807.

Saber, S.M. (1993). The use of multi - strain biofertilizer in Agriculture. Theory and practice. Proc. of 6th Int. Symposium on Nitr. fixation with non- legumes, Ismailia, Egypt.

Seadh, S.E. and M.A. Badawi (2007). Wheat response to sowing methods and nitrogen fertilizer levels. J. Agric. Sci. Mansoura Univ., 32 (1): 1-10.

Seleiman, M.F., M.E. Ibrahim, I.H. Darwish and A.N.M. Hardan (2021). Effect of mineral and organic fertilizers on yield and quality of some egyptian and omani wheat cultivars. Menoufia J. Plant Prod., 6: 351–372. https:// mjppf.journals.ekb.eg/

Singh, N.P., R.S. Sachan, P.C. Pandey and P.S. Bisht (1999). Effect of a decade long fertilizer and manure application on soil fertility and productivity of rice wheat system in Molisols. J. Indian Soc. Soil Sci., 47:72-80.

Snedecor, G.W. and W.G. Cochran (1988). Statistical Methods. 7th Ed., The Iowa State University Press, Ames, Iowa, USA, ISBN : 0813815606.

Sugar, E., Z. Berzseny, T. Arendas and P. Bonis (2016). Effect of nitrogen fertilization and genotypes on the yield and yield components of winter wheat. J. Land Manag., Food and Environ., 67(1): 25-34.

Szmigiel, A., A. Oleksy and M. Kołodziejczyk (2014). Effect of nitrogen fertilization on quality and quantity in spring wheat. Elect. J. Polish Agric. Univ. (Ejpau). 17(2): 1-7.

Tababtabaei, S.A. and G.H. Ranjbar (2012). Effect of different levels of nitrogen and potassium on grain yield and protein of wheat. Intern. Res. J. Appl. Basic. Sci., 3(2): 390-393.

Tayebeh, A., A. Abass and A.K. Seyed (2010). Effect of organic and inorganic fertilizers on grain yield and protein banding pattern of wheat. Aust. J. Crop Sci., 4(6): 384-389.

Tehulie, N.S. and H. Eskezia (2021). Effects of nitrogen fertilizer rates on growth, yield components and yield of food barley (*Hordeum vulgare* L.): J. Plant Sci. and Agric. Res., 5 (1): 46.

Thirupathi, G.E., CH.V. Sugar and K.B.S. Devi (2016).Effect of nitrogen and sulphur levels on growth, yield quality and economics of single cross hybrid maize (*Zea mays* L). Int. J. Sci., Environ. and Technol., 5 (5): 2989 - 2998.

Umesha, S., M. Srikantaiah, K.S Prasanna, K.R. Sreeramulu, M. Divya and R.N. Lakshmipathi (2014). Comparative effect of organics and biofertilizers on growth and yield of maize (*Zea mays.* L). Current Agric. Res. J., 2 (1): 55-62.

Waddington, S.R., H.K. Murwira, J.D.T. Kumwenda and D. Hikwa (1998). Soil Fertility research for maize based farming systems in Malawi and Zimbabwe, (3):24-25.

Wahba, M., F. Labib and A. Zaghloul (2019). Management of calcareous soils in arid region. Int. J. Environ. Pollut. and Environ. Mod., 2 (5): 248-258.

Waller, R.A. and D.B. Duncan (1969). A bays rule for the symmetric multiple comparison problem J. Ame. Stat. Assoc., 64: 1484-1503.

Watanabe, F.S. and S.R. Olsen (1965). Test of an ascorbic acid method for determining phosphorus in water and NaHCO3 extracts from soil. Soil Sci. Soc. Am. Proc., 29: 677-678.

Youssef, S.M., S.E.D.A. Faizy, M.H. Hegazy and H.R. El-Ramady (2011). Effect of different nitrogen and potassium levels and foliar application of boron on wheat yield. In: Böden verstehen- Böden nutzen- Böden fit machen, 3-9. http://eprints.dbges.de/691.

Youssef, S.M., S.E.D. Faizy, S.A. Mashali, H.R. El-Ramady and S. Ragab (2013). Effect of different levels of NPK on wheat crop in North Delta. Ann. Meeting of the German Soil Sci. Soc. from 07 to 12 September 2013 in Rostock; Lectures Commission IV, reports the DBG (not peer-reviewed online publication). www. db ges. de.

Zaghloul, R.A., T.M. El-Husseiny, E.A. Hanafy, R. Agh and H.M. Abdel Rahman (2010). Effect of biofertilization and organic manuring on soil dehydrogenase activity, macronutrients and essential oil content of marjoram. Egypt. J. Microbiol. Special Issue 13th Conf. Microbiol., 15–32.

تحسين كفاءة التسميد النيتروجينى لنبات الشعير النامى فى تربة رملية جيـرية باستخدام الأسمدة العضوية والحيوية

مروة محمد السيد[1]- صلاح محمود دحدوح[2]- ممدوح محى الدين برعاص[1]- مصطفى محمد مصطفى الصاوى[2]

1- قسم الأراضى – معهد بحوث الأراضى والمياه والبيئة – مركز البحوث الزراعية – مصر

2- قسم علوم الأراضي – كلية الزراعة – جامعة الزقازيق – مصر

أجريت تجربة أصص لدراسة إمكانية إحلال الأسمدة العضوية والحيوية جزئياً أو كلياً محل الأسمدة النيتروجينية المعدنية بهدف تحسين كفاءة التسميد النيتروجيني لنبات الشعير (*Hordeum vulgar, Giza* 123) النامى فى تربة رملية جيرية تحصل عليها من محطة البحوث الزراعية بالنوبارية. أضيف السماد الفوسفاتى بمعدل 15 مجم فو كجم تربة$^{-1}$، وأضيف السماد البوتاسي بمعدل 30 مجم بو كجم تربة$^{-1}$. بينما أضيف السماد النيتروجينى المعدنى على صورة نترات الأمونيوم بمعدلات 30 ، 60 ، 90 ، 120 مجم ن كجم تربة $^{-1}$ على التوالى. أضيف التسميد العضوى من مصادر مختلفة " سماد الدواجن ، سماد الكمبوست ، سماد زرق الحمام " بمعدل 30 مجم ن كجم تربة$^{-1}$ على أساس محتواها من النيتروجين، وذلك مع الأسمدة الحيوية " السريالين، الفوسفورين " بواقع 5 جم إصيص$^{-1}$ خلطت جيداً بالتربة. أخذت العينات النباتية في مراحل نمو مختلفة " التفريع القاعدي، طرد السنابل، النضج " وذلك عند 45 ، 75 ، 140 يوم من الزراعة على التوالى . وتم تقدير محتوى النبات من المادة الجافة ، العناصر الغذائية الكبرى (NPK) ، وكذلك المحصول وجودته. وقد أظهرت النتائج ما يلى: تحصل على أعلى قيمة للمادة الجافة عند إضافة " سماد الكمبوست + السريالين " مع نترات الأمونيوم بمعدل " 90 مجم ن كجم تربة$^{-1}$. تحصل على أعلى قيمة للنيتروجين عند إضافة " سماد الدواجن + السريالين" مع نترات الأمونيوم بمعدل " 60 مجم ن كجم تربة$^{-1}$ ". تحصل على أعلى قيمة للفوسفور عند إضافة " سماد الدواجن + الفوسفورين " مع نترات الأمونيوم بمعدل "60 مجم ن كجم تربة$^{-1}$ ". تحصل على أعلى قيمة للبوتاسيوم عند إضافة " سماد الدواجن + السريالين "مع نترات الأمونيوم بمعدل" 90 مجم ن كجم تربة$^{-1}$ ". تحصل على أعلى قيمة لمحصول القش، الحبوب، وكذلك محتوى البروتين فى الحبوب عند إضافة " سماد الدواجن + السريالين " مع نترات الأمونيوم بمعدل " 60 مجم ن كجم تربة$^{-1}$ ".

المحكمـــان:

1- أ.د. رأفت خلف الله ربيـــــع أستاذ الأراضى المتفرغ – كلية الزراعة – جامعة قناه السويس.

2- أ.د. أحمد عفت أحمد الشربينى أستا ذ الأراضى المتفرغ – كلية الزراعة – جامعة الزقازيق.